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Economic Commission for Europe

PROBLEMS ARISING IN THE ESTABLISHMENT AND DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN LESS DEVELOPED COUNTRIES

By The Steel, Engineering and Housing Division, Economic Commission for Europe

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NOTES

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D.7. Problems arising in the establishment and development of the iron and steel industry in less developed countries. by the Steel, Engineering and Housing Division, ECE.

1. Iron and steel products hold a key position in economic development since they constitute an important material component of agricultural and industrial equipment, power installations, transport facilities, construction and, at later stages, of many durable consumer goods. A close correlation exists, therefore, between indicators of economic growth (e.g. gross national product per capita, gross domestic fixed capital formation, industrial output, private consumption expenditure, etc.) and steel consumption per capita.[1] Furthermore, the product pattern of steel consumption undergoes certain changes concurrently with growth from early stages of development to mature industrial economies. In the initial phases of development relatively heavy and technically simple iron and steel products are required, such as iron castings and cast iron pipes, light forgings, concrete reinforcement rods, rails, merchant bars, heavy sections and galvanized sheets. With the development of light industries the demand for steel is expanding and the product pattern may change according to the nature of these industries, especially if metal using industries are concerned. In later stages of development, iron and steel products of a higher degree of finishing are needed. This is reflected in the increasing use of flat products (strip, plates and sheets) especially for consumers' durables, motor vehicles and certain types of machinery. Exceptions to this general sequence occur mainly in those countries where a particular activity, e.g. mining, crude oil production, meat-canning etc., requires specific steel products such as rails, sections, tubes or tinplate.

2. In countries which do not possess a steel industry, when economic development is started on a broad front, large quantities of steel products are required, which must be imported from industrialized countries. The scarcity of foreign exchange creates a strong incentive to establish an iron and steel industry in the country itself. This is sometimes favoured by the existence of sizeable iron ore reserves of sufficient quality, often already exploited and exported. Energy resources, whether in the form of coking coal, thermo or hydro-electricity, are in most cases scarce or insufficiently developed. A major problem also is the lack of skilled labour, a problem which is particularly important in the steel industry, since steel workers with sufficient technical skill can only be formed by long practical experience. It is for these reasons that in countries which do not have an iron and steel industry, the establishment of such an industry, which involves sizeable investments, is undertaken in carefully considered stages which proceed hand in hand with the increasing availability of skilled labour. This last problem is relatively easier to solve in those countries where iron and steel production has already existed for some time, and where economic development plans call for an expansion of output.

Problems of programming

3. The close relationship between steel consumption (or production) and economic development calls for the establishment of co-ordinated growth programmes for the iron and steel industry and for the other sectors of the economy. The size and the economic significance of an iron and steel industry requires a careful and detailed planning of the adjacent sectors, in particular of iron and manganese ore deposits, coking coal, energy resources, transport

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1) See "Long-term trends and problems of the European steel industry", ECE Geneva, 1959 (ST/ECE/STEEL/1), especially Chapters V and VI.

facilities, labour (not only for the steel industry itself, but also for the complementary branches) and of the market for the future output of iron and steel products. Although there is a vast potential demand for steel products in developing countries, it is important to evaluate the quantities, types and qualities of individual products required by the various steel consuming sectors.

4. In the establishment of a programme for the erection of an iron and steel-industry consideration is given to the following:

(a) A quantitive and qualitative survey is made of iron and steel-making raw materials (iron ore, maganese ore, limestone, coking coal, water, scrap, etc.). Since in many cases the type of equipment used in a specific plant depends on the quality of raw materials (e.g. high-phosphorous ores may lead to the use of oxygen-blown converters instead of open-hearth furnaces; in the absence of iron ore, a regular supply of scrap suggests the use of small electric furnaces; a lack of coking coal will result in the use of low-shaft furnaces, or other direct reduction installations, etc.), the suppliers of plant equipment will often carry out such surveys.

(b) The choice of the site of a plant is influenced by a number of factors which must be carefully evaluated. Calculations of assembly costs for raw materials and for shipments of finished products to the principal market area are required. The proximity of an industrial centre as a steel outlet, the availability of skilled labour, of port and other transport facilities, etc. will be given particular weight in such considerations.

(c) In addition to the considerations relating to the quality and type of raw materials, the choice of equipment and individual production processes depends on considerations of a purely technical and financial nature, since different types of equipment have different investment and operating costs, require varying degrees of skill of labour, or are suitable only for certain production programmes.[2] The final choice is also, sometimes, influenced by the availability of advantageous credit conditions.

(d) The planning of the production programme is dictated by the general plan for development, by the availability of technical know-how, and by cost considerations. Calculations are made of the total cost of a ton of a given type of finished product and compared with the price of a corresponding imported product. Often the cost of domestically produced steel compares, at least during the initial stages, unfavourably with similar imported products. This may be, however, offset by other considerations relating to foreign currency savings and general economic policy.

5. Often, especially in those countries where a domestic iron and steel production is established for the first time, the choice will be for relatively simple products in view of limitations in technical experience. This coincides generally, at early stages of development, with the requirements of the economy. More advanced products, (especially thin flats, cold-rolled sheets, steel tubes, etc.) are imported, and only later, as technical skill grows with experience will they be produced domestically.

6. In countries where iron ore is already mined for export, the establishment of an iron and steel industry may be approached differently: iron-making facilities are built often with technical and financial aid from the ore

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2). This problem has been dealt with in an ECE study Comparison of different steel-making processes (U.N. Publication Sale No.62.II.E/4, Geneva 1962) summarized in another paper submitted to the Conference.

importer and pig-iron is produced, partly for domestic use, and partly for export instead of iron ore. The advantage in transport cost is considerable (pig-iron has an Fe content of over 90 per cent against about 60 per cent in the case of high quality iron ore). Coke required for the production of pig-iron is imported by taking advantage of low return-freight rates of ore carriers. During the first years technical assistance in production is generally required to produce pig-iron of sufficient and constant quality in order to satisfy the users in industrialized countries.

7. Countries which aim at expanding an existing steel industry of some size, are greatly aided by the fact that experience exists already in programming and in steel-making techniques. Problems arising in output programming will be less considerable since the size and type of demand in the different sectors of the economy will be known through practical experience. Problems relating to the assessment of the effects which an expansion may have on raw materials, energy, the transport system and the labour force will remain approximately the same.

Problems of Financing

8. The price of iron and steel-making equipment and the cost of its installation are comparatively high, its actual level varying from country to country with the type of process used and the size of plant built. As a generally accepted rule-of-thumb, US$ 300 are taken as the cost of installing one ton of crude steel capacity in an integrated iron and steelworks; 3) consequently for setting up an integrated plant of 1 million tons crude steel capacity, US$ 300 million are required, and it is evident that this is beyond the credit capacity of many individual enterprises. Moreover, new iron and steel plants are not immediately profitable and offer, therefore, little incentive for foreign private capital investment. In those cases where suppliers of equipment advance loans or make direct investments in developing countries, these are generally guaranteed by the government or by inter-governmental agencies.

9. For the governments of the less developed countries, investment in a new iron and steel industry may represent a heavy drain on financial resources. As a result, new steel projects are often financed jointly by the government of the receiving country, international financial institutions, grants or loans from foreign governments, equipment producers and sometimes enterprises of the iron and steel industry establishing subsidiary plants abroad or serving as technical advisers. Only for the expansion of existing plants (for instance when a new blast-furnace is built or a steel-making furnace added to an existing shop), is one source of finance used in current practice.

10. Among the problems of financing iron and steel industries in developing countries two divergent factors are of considerable importance: on the one hand, it is economically advantageous to set up immediately sizeable units with a crude steel capacity of 1 million tons or more; on the other hand the lack or insufficiency of technical know-how and skilled labour as well as capital often calls for a development by successive stages, starting with one only or a combination of two successive of the three main phases of integrated

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3) See also "Long-term Trends and Problems of the European Steel Industry, E.C.E., Geneva, 1959, page 142, notes to table 94.

steel production, namely pig-iron making, crude-steel production or steel rolling and finishing. This approach may, in the long run, imply higher total costs and hence greater financial charges for the country concerned. On the other hand, it may avoid considerable initial losses and delays arising from shortcomings in technical know-how.

Labour problems

11. The training of skilled labour and technical personnel for the steel industry requires a relatively long period of time, since many operations in iron and steel production require, despite a generally well advanced state of automation, the interference of humans, based on judgement. Even in well established steel-producing countries, new installations will only reach full capacity and produce a satisfactory product after several months of experience. Moreover, many operations, especially in crude steel-making, cannot as yet be automated, and the quality of steel through certain additions to the steel-bath at the right moment may largely depend on the decisions of an experienced foreman. The shortage in developing countries of qualified workers directly attached to the production process is further aggravated by the need for highly qualified maintenance and repair personnel.

12. Prior or during the construction of an iron and steel plant, personnel at the foreman, technician and engineer level are often trained by the suppliers of equipment in the country of origin. It has also become common practice to establish technical colleges in order to provide some of the basic knowledge required for successful operation before production is started and during the lifetime of the plant.

13. An important contribution to training of skilled labour is made by engineers from industrialized countries who usually accompany the imported equipment, supervise its installation and remain for a certain "break-in-period" of the new plant.

14. The training of a sufficient number of workmen poses great difficulties, since a plant of 1 million tons of crude steel capacity usually employs between 10,000 and 15,000 workmen (as distinct from engineers, technicians and administrative personnel). Even if a relatively low level of skill is needed for the greater part of these workers, their formation requires a considerable schooling capacity. Moreover, the minimum technical skills required take sometimes years to develop in a given population group. Most of the workmen's training in new plants is undertaken by foremen and technicians.

15. In less-developed countries where there already exists a steel plant, the creation of a new plant is facilitated by the possibility of training well in advance a great part of the personnel required and of transferring or assigning temporarily to the new works experienced personnel from the existing plant. Internationally, great progress has also been made during the post-war years in providing help in training. There are many facilities provided under the bilateral aid programmes, and among the services offered by the international organisations, the manifold training activities sponsored by the International Labour Organization under the United Nations technical assistance programme and the Special Fund, and the group-fellowships programmes sponsored by the United Nations deserve special mention.

Concluding Remarks

16. The foregoing account touches only briefly upon some of the major problems arising in the establishment of iron and steel industries in developing countries. In addition to the usual difficulties encountered in the industrial development of these countries, the steel industry poses particular problems, in view of the size of the investments, the site and the skills of the labour force and the conditions relating to the prior or concurrent development of the needed raw materials and energy supply. The difficulties encountered are, however, by no means insurmountable, and experience shows that initial frictional losses decrease in importance, and that the time required for starting domestic iron and steel production is steadily shortening. International co-operation in this field has also been steadily expanding, facilitated by the fact that both the raw materials and the outlets of the iron and steel industry occupy an important position in international trade. Until the time comes when many of the less developed countries will have their own iron and steel industry, one area of further international co-operation may yield significant benefits, namely the pooling together of the resources of neighbouring countries in order to establish iron and steel plants with an economic size able to count on the markets of all participating countries. This avenue of co-operation is being given high priority in the United Nations and its regional economic commissions, especially the Economic Commission for Africa.

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